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Palaeontological Society of Japan

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10. *On A Fossil Elephant, Palaeoloxodon aomoriensis, from Shichinohe, Kamikita-gun, Aomori Prefecture, Japan.*

By

SHIGEYASU TOKUNAGA and FUYUJI TAKAI

[Received February 27th; read February 29th, 1936]

Thirty years ago, some fossil remains of an elephant were unearthed from a Pleistocene deposit at Tenjinbayashi, on the right bank of the Shichinohe-gawa, near the entrance to the town of Shichinohe, Kamikita-gun, Aomori prefecture. Recently the senior writer was informed of this excavation by Mr. Yaichiro YAMAGUCHI, and received two photographs of these fossil remains and of the locality of the excavation from Mr. Kenji ARAKAWA, instructor at the Aomori Normal School. He later learned that the fossil specimens are now preserved at the Tokyo Agricultural College through the efforts of Mr. Shuzo ISHIDA, one of its professors. They consist of a complete right lower cheek-tooth, many fragments of the next cheek-tooth (unworn), an almost complete right incisor tooth, a fragment of a right mandible, and a left ulna together with many fragments of bones that had belonged to the same animal. The senior writer then reported the occurrence of these remains, together with the description of a new species *Palaeoloxodon aomoriensis* TOKUNAGA and TAKAI, in the Journal of Geography, published by the Tokyo Geographical Society.

According to Mr. Kinji KANEHARA, this Pleistocene deposit, which is developed extensively on the environs of, and along the eastern part of the town of Shichinohe, consists chiefly of alternations of grayish coloured clay and sand, and gravel, intercalated

with lenses of dacitic pumice, and covered with volcanic detritus from Mts. Hakkoda and Iwaki. In the western part of Yamadate near the town of Shichinohe, basal conglomerate nearly one meter thick covers the Tertiary formation unconformably. The pebbles of the conglomerate bed consist of liparite, two-pyroxene andesite, quartzite, and slate. At Saiichida and Sakainosawa there is a bed of *Ostrea gigas* THUMBERG. Mr. Junzo ÔHINATA reported *Ostrea denselamellosa* LISCHKE from the neighbourhood of Furumaki. Judging from the fossil remains of the elephant and the topography of the region, the geological age of the deposit of this district may be Upper Pleistocene.

Acknowledgement and thanks are due to Messrs. S. ISHIDA and K. ARAKAWA for their courtesy in permitting the writers to study the collection and the photographs, as also to Mr. Y. YAMAGUCHI for having kindly informed us of the excavation. The writers have the further pleasure of expressing here their thanks to Mr. K. KANEHARA for his geological investigation and to Mr. H. KUNO for his determination of the volcanic rocks.

Palaeoloxodon amoriensis TOKUNAGA and TAKAI, 1936.

Plates 13 (3), 14 (4)

1936. *Palaeoloxodon amoriensis*, Journ. Geogr. Soc. Tokyo, Vol. XLVIII, No. 564, pp. 67-70, pl. 1.

INCISOR

The almost complete right incisor tooth measures 770 mm long and is twisted slightly to the right. The diameter at the middle is about 52 mm and at its proximal part about 65.5 mm. Its curvature approximately equals that of the circumference of a circle of 800 mm diameter.

LOWER MOLAR

This complete and excellently preserved cheek-tooth belongs to the right ramus of the mandible described below. The grinding surface of this molar has the form of an elongated ellipse. The present specimen retain fourteen ridge-plates. If the fore- and hindmost ones are assumed to be the fore and aft talons respectively, the ridge-plate formula is $\times 12 \times$. The length of the molar on its grinding surface measures 126 mm, its width is 47 mm at

the fifth ridge-plate, while the distance between the base of the crown and the grinding surface is 96 mm at the twelfth unworn ridge-plate. At the well worn anterior ridge-plates the enamel figures expand in their mesial parts and show a distinct lozenge outline. The lateral sides of each ridge-plate slightly curve in anterior direction. The cement layer is generally thin, the posterior angle of one touching the anterior angle of its neighbour. The plication of the enamel layer, which is 1.9-2 mm thick, is very strong. The lamellar frequency is nine-and-a-half in a standard length of one hundred millimeters. This specimen may be the first true molar. Besides, there are preserved some broken ridge-plates of an unworn next molar. One of them measuring 87.5 mm high, 51 mm wide, and 13 mm thick, has six mammillae.

MANDIBLE

The mandible is a fragment of the right mandibular ramus containing a well-worn molar (above mentioned). The condyloid and the coronoid processes, the symphysis, the lingual side of the fragmentary ramus, and the anterior part of the alveolar margin are broken off. The anterior border of the upper portion of the coronoid process is almost perpendicular to the alveolar margin. The lower border of the horizontal ramus and the posterior border of the ascending ramus is curved, its curvature being approximately equal to that of a circle of about 250 mm radius. The alveolar border and the lower border of the horizontal ramus converge backward at an angle of about 25°. The height of the horizontal ramus is smallest at the base of the coronoid process. The mandibular ramus measures as follows (in mm.):

Length from anterior end of the broken coronoid process to	
posterior end of the broken condyloid process.	205 mm
Depth of horizontal ramus just in front of the base of the	
ascending ramus.	106
Height to the broken condyloid process.	ca 240
Height to the broken coronoid process.	ca 180
Distance between grinding surface and alveolar margin.	38

ULNA

The specimen belongs to the left side, the anconaeus process having broken off. Its measurement is as follows (in mm.):

Total height.....	310 mm
Greatest breadth of proximal plane of articulation.	124
Greatest breadth of distal extremity.	100
Girth at middle.....	174

Judging from the size of the molar, the number of ridge-plates, and the length of the left ulna, the present species is the smallest type of palaeoloxodont group ever described from Japan or elsewhere. On account of the very distinct lozenge-shaped enamel figures, the species resembles *P. tokunagai* MATSUMOTO, but it has a higher lamellar index. Neither *P. naumanni* MAKIYAMA, *P. namadicus setoensis* MAKIYAMA, *P. namadicus yabei* MATSUMOTO, nor *P. yokohamanus* TOKUNAGA has the higher lamellar frequency that is found in the present species, nor has the distinct loxodont enamel figures. The writers therefore regard the present fossil species as a new undersized *Palaeoloxodon*. It is considered that *Palaeoloxodon namadicus* FALCONER and CAUTLEY probably migrated from India to Japan during Upper Pliocene or Lower Pleistocene. After that migration several Japanese *Palaeoloxodon* was derived. According to the assumption that the lamellar frequency is an indication of the evolutionary stage of an elephant and to Mr. K. KANEHARA's opinion that the bed containing the fossil remains belongs to Upper Pleistocene, the writers suppose that the present species may be the Upper Pleistocene type of *Palaeoloxodon*.

Palaeoloxodon amoriensis に就いて (摘要)

徳永重康 高井冬二

青森縣上北郡七戸町天神林にて約 30 年前用水路開鑿の際更新統中から發見されたものである。當時同一動物體に屬すると思はれる頭骨、下顎骨、象牙、尺骨、脊椎骨、肋骨等多數發掘されたが、皆四散し僅かに右象牙、第一後臼齒付右下顎骨、左尺骨、及び二、三の骨片が東京農業大學に保存されて居る。

地質は金原均二理學士の調査に依るもので其報告は筆者の一人徳永が地學雜誌 2 月號に掲載した。其結果によれば象含有層の年代は上部更新世に屬すといふ。

Palaeoloxodon amoriensis TOKUNAGA and TAKAI

下顎骨に附著せる第一後臼齒の咀嚼面は長橢圓形をなす。前後の「タロン」及び 12 の稜

を有す。咀嚼面に於ける長さは 126 mm, 幅は第五稜にて 47 mm, 齒冠と咀嚼面との間の高さは第十二稜にて 96 mm である。よく磨削された稜は著しき菱形をなし, 其中央部は前後に突出し各尖端部は(特に第五, 第六稜に於て)互に接近する。本種は日本に普通な *Palaeoloxodon namadicus* の何れよりも稜の形は菱形を呈する。珐瑯質の皺は非常に強く, 稜の厚さは 1.9-2 mm ある。100 mm に含まれる稜数は 9.5 である。

猶ほ下顎骨中にあつて未だ磨削の域に達して居らない第二後臼齒の破片數個がある。

門齒は殆んど完全に長さ 710 mm, 直徑中央部にて 52 mm, 根元にて 65.5 mm, 屈曲率は直徑 800 mm の圓周の一部に相當する。右牙である。

下顎骨は烏喙突起, 踝狀突起, 縫合部及び内側片の全部缺損して居る。

尺骨は長さ 310 mm にて, 鷹嘴突起は破損して居る。

第一後臼齒の大いさ, 100 mm に含まれる稜數及び左尺骨の大いさ等より本種は從來日本及び外國に於て發表された *Palaeoloxodon* 屬に比し小型の象である。上部鮮新世, 或は下部更新世に印度より渡來したる後日本に於て數種の象に分化したのである。100 mm に含まれる稜數が本屬の時代を表はすものと假定すれば, 本種は上部更新世に屬するものと想像され, 其點に就ては金原學士の地質調査の結果と何等矛盾しない。

Explanation of Plates 13 (3), 14 (4)

Palaeoloxodon aomoriensis TOKUNAGA and TAKAI.

- Fig. 1. Crown view of first true molar. $\times 2/3$.
- Fig. 2. Outer view of same. $\times 2/3$.
- Fig. 3. Left ulna. $\times 1/3$.
- Fig. 4. Outer view of right mandible. $\times 1/3$.
- Fig. 5. Incisor. $\times 1/6$.

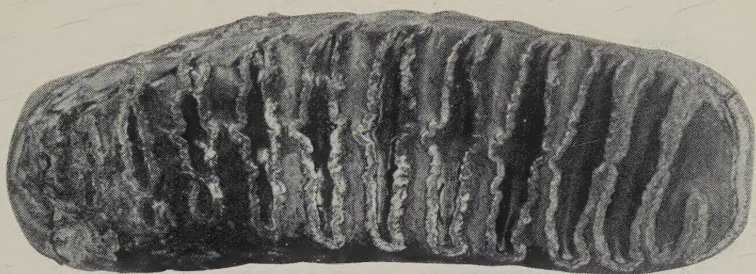


Fig. 1



Fig. 2

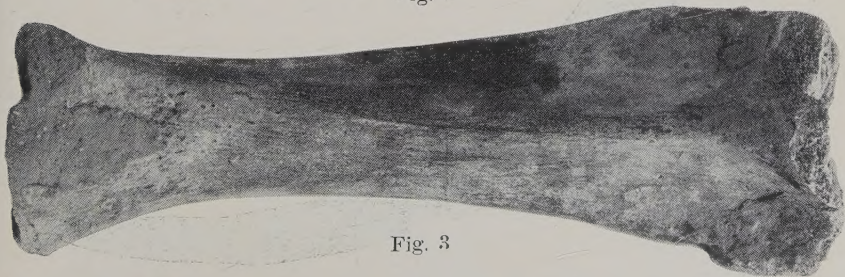


Fig. 3



Fig. 4

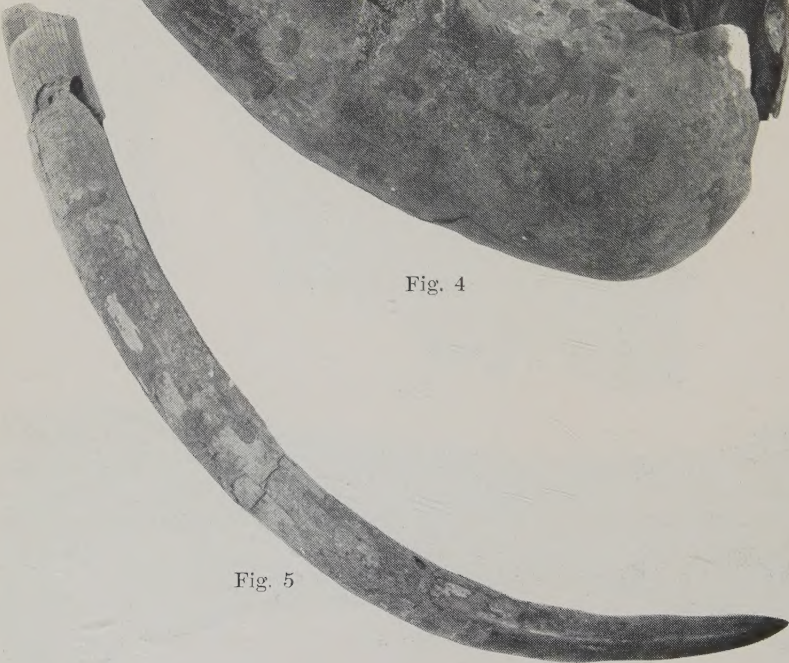


Fig. 5

11. 棘口蘇蟲 *Microporina articulata*

(FABRICIUS) に就て

坂 倉 勝 彦

[昭和 11 年 2 月 27 日受理, 2 月 29 日講演]

Microporina articulata は *Cellaria borealis* (BUSK) として屢々報告された棘口蘇蟲で, FABRICIUS により Groenland から最初に記載されたものである。F. BORG [2] によると arctic, boreal に分布する種とされてゐるが太平洋では更に南方まで擴がつてゐて東側では Queen Charlotte Is., Vancouver, California に, 西側では北千島に知られてゐる。更に津輕海峡から *Microporina japonica* CANU & BASSLER として記載されたものも後述する如く同物異名と考へられ分布は一層擴がる。他方化石としての産出は筆者の知る限り現在まで全然ない模様である。

以下に日本産化石並びに現世標本に就て記述する。標本入手にあたつて御好意を辱くした新野(津輕海峡産現世標本), 朝比奈(尻矢崎産同上), 長尾(北海道産化石), 徳重(佐渡産化石)の諸氏に深く感謝したい。

Microporina articulata (FABRICIUS)*Cellularia articulata*, FABRICIUS, 1821, p. 27.*Salicornaria borealis*, BUSK, 1855, p. 254, pl. 1, figs. 1-3.*Cellaria borealis*, SMITT, 1867, pp. 238 and 361, pl. 20, fig. 17; HINCKS, 1882, p. 463; ROBERTSON, 1905, p. 287, pl. 14, fig. 86 and pl. 16, figs. 1-3; OKADA, 1933, p. 214.*Microporina borealis*, LEVINSEN, 1909, p. 162; O'DONOGHUE, 1926, p. 49.*Cellaria articulata*, NORDGAARD, 1906, p. 8.*Microporina articulata*, BORG, 1933a, p. 526.*Microporina japonica*, CANU and BASSLER, 1929, p. 139, pl. 14, figs. 9-11.

1. Description of specimens from Tugaru Strait.

Zoarium free, branched. Internodes cylindrical, consisting of

11 rows of zooecia.

Zooecia rectangular, much elongated, separated distinctly; mural rim finely granulated, very thick, a little narrower than or as large as one half the width of depressed cryptocyst, broadest at the middle, tapering distally and proximally. Cryptocyst deep, ornamented with granules somewhat larger than those on raised rim, punctured, bearing two small opesiules on each distal corner. Opesium transverse, semielliptical with straight proximal border. Avicularium with pivot, independent, large, elliptical, situated above the aperture, bordered with raised and granulated rim as the zooecia; its mandible directed proximally. Rosette-plate uniporous, 6 to 8 on each lateral wall.

Occurrence. St. 646 (I.F.E.S.), North of Gogensaki; $41^{\circ}13'N$; $140^{\circ}12'45''E$; 123 m.

St. 9150027 (H. D. I. N.), off Siriyasaki; $41^{\circ}28'48''N$; $141^{\circ}32'30''E$; 66 m.

2. Description of specimens from Sado Is.

Internodes slender, consisting of about 10 rows of zooecia. Mural rim narrower than that of Tugaru specimens. Opesium variable in size, sometimes nearly elliptical, slightly contracted proximally, with straight proximal border.

Occurrence. Pliocene.

Sawanemati, Sado Is.

3. Description of specimens from Hokkaidô.

Internodes usually cylindrical, sometimes rather compressed and expanded distally. In the latter case, they consist of about 16 rows of zooecia.

Zooecia of the cylindrical part, similar to those of Tugaru specimens. Those of the expanded part, a little elongated, sub-hexagonal, separated by thin mural rim; cryptocyst depressed, almost flat, finely granulated, punctured by rather large pores; opesium large, longer than one third the zooecia, semiorbicular with straight proximal border; opesiules sometimes indistinct.

Most of the differences between zooecia of these two types seem to owe to the different degree of calcification.

From the same localities, there are collected, though not so frequently, another delicate and slender form. Its internodes con-

sist of about 10 rows of zooecia which are elongated, rectangular and bordered by thin mural rim. The opesium is large, a little transverse and elliptical. The avicularium is somewhat smaller than the opesium. Notwithstanding of the shape of opesium being elliptical, I have placed this form under the same species as forms above described.

Occurrence. Setana Series (Pliocene).

Yubetu-mura and Kuromatunai-mura, Zyuto-gun, Siribesi, Hokkaidô.

4. Description of specimens from the Noto Peninsula.

Microporina articulata var. *notoensis* nov.

Internodes slender, cylindrical, formed of about 10 rows of zooecia.

Zooecia narrow, elongated, rectangular, arranged linearly. Frontal cryptocyst almost flat, granulated, minutely punctured, slightly raised distally. Mural rim thick, one fourth to one third the width of depressed cryptocyst. Opesium small, fairly transverse, semielliptical with proximal border, straight or somewhat concave. Opesiule small, four to five on each side. Avicularium independent, narrower and higher than opesium.

This form is characterized by its smaller dimensions and by the occurrence of many opesiules.

Occurrence. Nanao Beds (Middle Miocene).

Environs of Nanao-mati, Isikawa-ken.

Measurements (mm) :—

Localities	Zooecium		Opesium		Diameter of Internode
	Length	Width	Height	Width	
1. Tuguru Str. (St. 646)	0.90-0.10	0.25-0.30	0.10	0.18-0.20	1.0-1.17
2. Sado	0.84	0.25	0.12	0.13-0.18	0.84-1.0
3. Hokkaidô (expanded pt.)	0.75-0.84	0.33-0.38	0.15-0.20	0.18-0.23	about 2.2
(cylindr. pt.)	0.75-0.84	0.33	0.10	0.20-0.22	1.17-1.50
(thin form)	0.84	0.25-0.28	0.13-0.17	0.17-0.18	1.0
4. Nanao	0.67-0.79	0.23	0.08	0.13-0.15	0.84

論 議

1909 年 LEVINSEN [15, p. 162] は *Cellaria borealis* (BUSK) SMITT を模式種として新屬 *Microporina* を設け之を Microporidae に屬せしめた。JELLY [13, p. 40] は *Onchopora borealis* BUSK [6, p. 213, pl 28, figs. 6, 7] をも該種の同物異名と見做したが、之は ascopore を持ち且つ areolae を明瞭に具へる點に於て區別さるべきである。恐らく亞目 Ascophora 中の Tubucellariidae 附近に分類せられるものであらう。1929 年津輕海峽より *Microporina japonica* として CANU 及び BASSLER に依つて報告されたものは、兩氏によると opesium 及び蟲室がより小さい點で *M. articulata* から區別されるといふ。之等の性質が變化に富む事は前記の計測値に見られる通りであり、ROBERTSON の圖示した California の標本も大さからは *M. japonica* になる。即ち *M. japonica* は *M. articulata* の同物異名とすべきである。

Microporina articulata の變異

1) 節間 (Internode) 形

Arctic, boreal 或は California の標本では節間は club 状であるが、津輕海峽産及び化石標本では圓筒状である。北海道産の化石では節間の先端部が薄く擴がる。直徑も變化に富み var. *notoensis* は最も細く、佐渡産の標本が之に次ぐ。

2) 石 灰 化

この作用の強弱が蟲室並びに附屬器官に種々の外觀を與へる事は衆知の事であるが、特に opesium の形狀、大きさに與へる影響は注意を要する。Opesium は上記の測値に見られる如く極く變化し易いものであつて、その大きさ、形の違ひが一次的のものであるか二次的のものであるかは觀察に當つて常に一應考慮する必要がある。*M. japonica* CANU & BASSLER の計測値は同じ津輕海峽から得た筆者の標本と必しも合致しない。且つ後者では壁縁は微小な顆粒に蔽はれてゐるが、前者では滑かである。之等の差異は主として石灰化の程度の微妙な差異に基くのであらう。Opesiule は opesium 程石灰化作用の強弱に影響

されない様であるが、之は七尾産の石灰化の著しいもの或は北海道産の石灰化の弱い標本の観察から推測される。

Microporina 及びその近縁屬、並びに夫等の分類に就て

Microporina は *Verminaria* 他數屬と共に *Coilostega* 中の *Calpensiidae* に入れられてゐる。前者では opesiule は通常 2 個、後者（模式種、*Membranipora oblonga* BUSK [5, p. 34, pl. 2, fig. 3]）では兩側に數個づゝ持つ事が第一の區別點とされてゐる。*Verminaria* 同様多數の opesiule を持つ屬として *Foraminella* LEVINSEN [15, p. 166], *Puncturiella* LEVINSEN [16, p. 373] がある。

Microporina articulata では opesiule は通常 2 個で不明瞭である。而し乍ら津輕海峡の標本を詳細に見ると、腹表面と壁縁との角に沿うて、最前端の 2 個の明瞭な opesiule 以外に 2, 3 個の小孔が穿たれてゐる事がある。之等の小孔は腹表上の小孔より幾分大きく、そのより顯著になつたものは var. *notoensis* を特徴づける小 opesiule である。*Microporina* の他の一種 *M. elongata* (HINCKS) は原記載 [11, p. 380, pl. 16, fig. 4] によれば opesiule は可成り大きく一對であるが、WATERS は該種（氏の標本の鳥嘴體はその形狀、顎の方向が原記載と一致してゐない¹⁾）に於ける opesiule の數は *Micropora lepida* HINCKS (*Foraminella* の模式種) の夫れと同様に變異し易いと記述してゐる [25, p. 8, pl. 1, figs. 21, 22]。かくの如く *Microporina* 屬は原則として opesiule を一對しか持たぬが、附加的になほ數個持ち得ると見なければならぬ。WATERS は JULLIEN, LEVINSEN と異り opesiule の種的形質としての價值を低く見積り *Micropora* 屬を用ひたが、更に極端な E. MARCUS は *M. elongata* を *M. coriacea* (ESPER) から分つ事にさへ疑を挿挟むでゐる。この MARCUS の考へは暫く問はないとしても、少くとも opesiule の種的、屬的價值は過大に見積つてはならないであらう。

1) この標本を *M. elongata* に完全に同定し得るや否やには尙疑問の餘地がある。少くとも forma 或は var. として一應の區別が望ましい。

Verminaria 屬 [14, p. 78] として知られてゐるものは模式種 *V. oblonga* (BUSK) と *V. areolae* SAKAKURA である。筆者は先に後者を記載した際、夫れが *M. elongata* に近似する事を指摘しつつも opesiule を多數持つ點から *Verminaria* に屬せしめた [22, p. 13]。而し模式種は鳥嘴體を缺き卵室を有してゐる。この兩特徴は前記 opesiule よりも分類上大きな價值を持つものと考へられる故、*V. areolae* は *Microporina areolae* (SAK.) と改めたい。*V. oblonga* は Coralline Crag から報告されて以來他所からの發見を聞かないが再検討を要する種である。今は endozoecial (?) ovicell, 明瞭な多數の opesiule をもつ事、鳥嘴體を缺く事を以て *Verminaria* 屬を認めておきたい。

現在 *Puncturiella* 屬としては次のものが知られてゐる。何れも歐洲の白堊紀産である。

1. *Puncturiella gudumensis* LEVINSEN (模式種)
2. *P. areolata* VOIGT
3. *P. mediopunctata* VOIGT
4. *P. exsculpta* (MARSSON)
5. *P. sculpta* (D'ORBIGNY) [佛蘭西 Senonian 産, CANU 及び BASSLER, 8, p. 37]

VOIGT は *Foraminella* と *Puncturiella* とは同物異名と考へたが、LEVINSEN が後者を設けた際兩者の區別を明かにしなかつたので白堊紀種に對して *Puncturiella* を採用した [24, p. 488]。兩屬とも hyperstomial ovicell を持つてゐるが、その異同を決定するには尙鳥嘴體、opesiule の性質を吟味する事が必要である。

上掲 *Puncturiella* とされたものゝ内、問題のある *P. sculpta* [原記載には全然 opesiule が畫かれてゐない。9, p. 72, pl. 655, figs. 16-18] を除くと、(1), (2) には hyperstomial ovicell があり (3), (4) には ovicell は知られてゐない。且つ (3) は鳥嘴體、opesiule の模様が非常に *Microporina areolae* に似てゐる。恐らく (4) と共に *Microporina* に移すべきものであらう。

上に述べ來つた諸屬は最近の CANU 及び BASSLER の分類 [7, p. 28; 1, p.

26]によれば亞目 *Anasca*, Division *Collostega* 中の次の諸科に配置されてゐる。

Calpensiidae *Microporina*, *Verminaria*

Thalamoporellidae *Puncturiella*

Aspidostomatidae *Foraminella*

又 VOIGT によれば *Puncturiella* = *Foraminella* は *Aspidostomidae* (= *Aspidostomatidae*) に屬する [24]。 *Calpensiidae* は ovicell を具へぬ事を最も重要な特徴とするが *Verminaria* は前述の如く夫れを有する故本科に入れるわけにはゆかない。 *Puncturiella* と *Foraminella* とは互に異なるにしても、科まで別にする事は出来ない。

棘口蘚蟲類の分類の内、亞目 *Anasca* の夫れは最近非常に整備して來たと考へられるのであるが、而も上の如く不備の點が少くない。現在の筆者の意見としては *Microporina* を *Microporidae* (或は *Microporinae*) に、他の三屬を *Aspidostomatidae* 中に置いておきたいが、之等科の分類に就ては今後の研究に俟つ積りである。

1936/II/22 東京帝大・地質學教室

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On *Microporina articulata* (FABRICIUS), a Cheilostomatous
Bryozoa. (Résumé)

By

Katuhiko SAKAKURA

1. The first occurrence as fossil of *Microporina articulata* is reported.
2. Recent and fossil specimens of this species and a new variety of it (var. *notoensis*) from Japan are described.

3. *Microporina* and related genera are discussed.

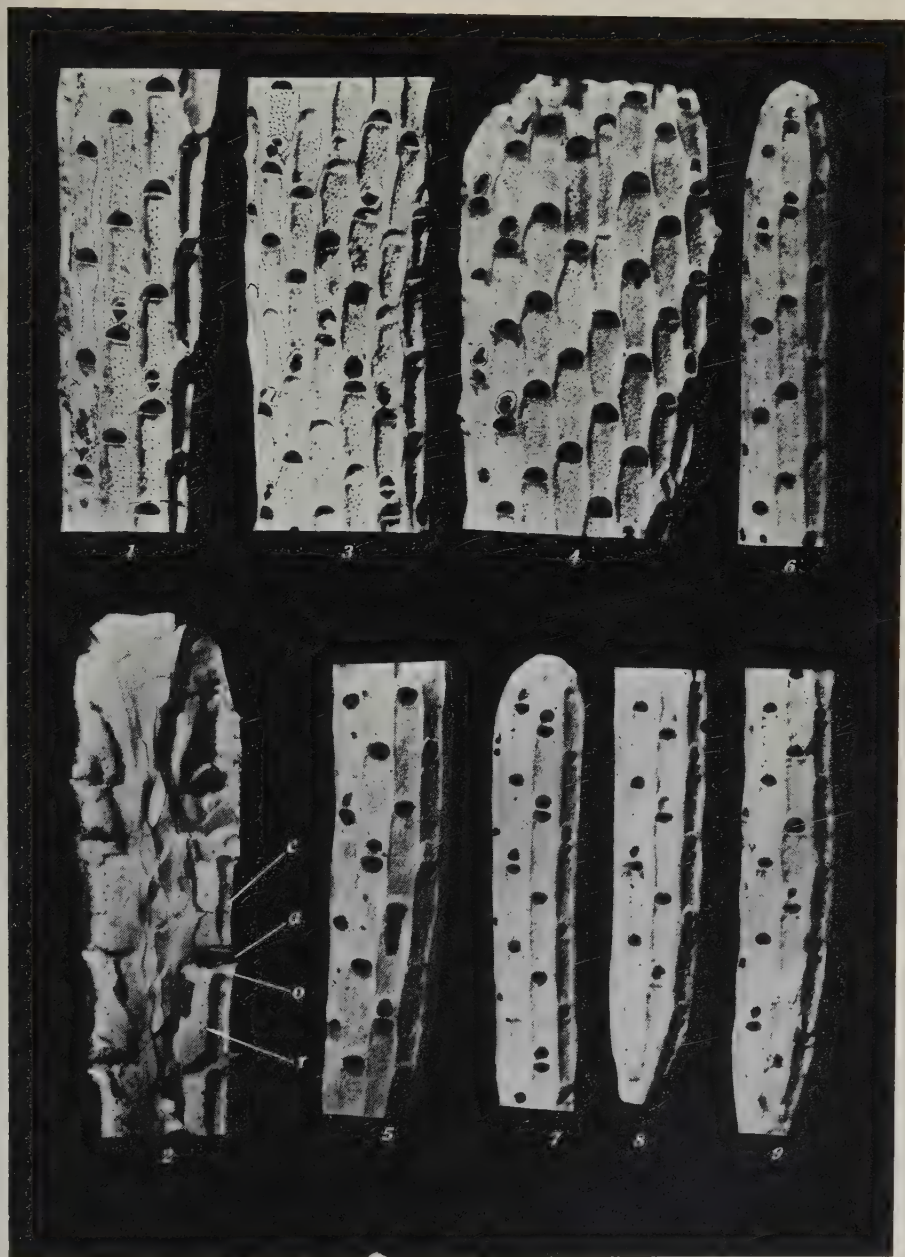
Explanation of Plate 15 (5).

(All the specimens are magnified $\times 16$.)*Microporina articulata* (Fabricius)

- Fig. 1. Recent specimens from Tugaru Strait (123 m).
Fig. 2. Longitudinal section of same specimen showing avicularium (a), opesium (o), depressed cryptocyst (c) and uniporous rosette-plates (r).
Fig. 3. Cylindrical part of internode. Setana Series (Pliocene). Nakanogawa, Yubetu-mura, Zyuto-gun, Hokkaidô.
Fig. 4. Expanded part of internode. Same locality.
Fig. 5. Thin form. Same locality.

Microporina articulata var. *notoensis* nov.

- Figs. 6, 7. Distal part of internode. Nanao Beds (Miocene). Iwaya, Nanao-mati, Noto Peninsula.
Figs. 8, 9. Proximal part of internode. Same locality.



12. A Note of the Fossil Marine Fauna from Okinawa-Zima, Ryûkyû Group

By

SITIHEI NOMURA and KOTORA HATAI

(Contribution from the Institute of Geology and Palaeontology, Tôhoku Imperial University, Sendai, Japan) [Received February 27th, 1936; read February 29th, 1936.]

Sometimes ago one of the authors (NOMURA) received from Mr. K. TSUJITA, a teacher of the Okinawa Girls Normal School, a small lot of marine fossils, collected by him from a limestone complex developed in the vicinity of the city of Naha, in Okinawa-zima.

The fossils are the following, namely; Pelecypoda: *Anodontia bialata* (PILSBRY), *Cardium* (*Nemocardium*) *beckei* REEVE, *Codakia divergens* (PHILIPPI), *Codakia* sp., *Corbis sowerbyi* REEVE, *Dosinia gruneri* PHILIPPI, *Macrocallista pacifica* (DILLWYN), *Ostrea ariakensis* FUJITA, *Paphia* (*Paphia*) cf. *amabilis* (PHILIPPI), *Pecten* (*Amussiopecten*) *praesignis* YOKOYAMA, *Thyasira nipponica* YABE and NOMURA. Gastropoda: *Conus capitaneus* LINNAEUS, *C. ebrneus* HWASS, *C. fulmen* LINNAEUS, *C. gastacapi* PILSBRY, *C. kikaiensis* PILSBRY, *Fusinus perplexus* (A. ADAMS), *Xenophora exusta* (REEVE). Cirripedia: *Coronula diadema* (LINNAEUS). Brachiopoda: *Pictothyris hanzawai* YABE, *P. picta* (DILLWYN). Echinodermata: *Clypeaster japonicus* L. DÖDERLEIN. Anthozoa: *Flabellum* sp.

Unfortunately since the stratigraphic position of the beds that yielded the fossils is unknown to us at the present time, it cannot be definitely stated to what geological formation they really belong. There are two possibilities of equal weight, one is, that the fossils from the limestone complex belong to the Ryûkyû limestone

formation,⁽¹⁾ and the other is, that they are from a different facies of the Simaziri Beds, a clastic formation unconformably underlying the Ryûkyû limestone complex just mentioned. If the latter, then the fauna represents a lateral change in facies of that group and may be safely referred to the Pliocene in age⁽²⁾

Among the fossils in the collection, particularly interesting are, *Pecten* (*Amussiopecten*) *praesignis* YOKOYAMA, *Thyasira nipponica* YABE and NOMURA, and *Coronula diadema* (LINNAEUS).

Pecten praesignis is very common in the Lower Pliocene deposits of the provinces of Tôtômi and Tosa, and is well represented in the Simaziri Beds of Okinawa-zima. It is interesting in the fact that, (1) it is much similar to *Thyasira nipponica* which will be stated in the next in its geological range in time, ranging from Miocene to Lower Pliocene in general (2) its distribution in fossil state is much different from that of the species, being known only from deposits lying either south or west of central Japan, (3) the short geological range and extensive distribution in southern and western Japan is a fact in need of consideration in dealing with the age of a geological formation yielding it.

Thyasira nipponica is distributed widely in the Neogene deposits from northern to southern Japan (Byôritu Beds of Taiwan), but is particularly abundant north of central Honsyû. It is interesting in the fact that, (1) it is a derivative of the species *T. bisecta*, (2) its geological range is mainly from Miocene to Lower Pliocene, (3) its geographical distribution in fossil state is much more extensive than that of *T. bisecta*, i.e., in Japan, (4) its associated fauna in the western or southern parts of Japan is quite unrelated to that of its northern association, and, (5) the reference of this species to an age younger than the Pliocene seems unlikely.

Coronula diadema is very common in the Lower Pliocene deposits of the Kwantô region, central Japan and has been reported from certain geological formations (Byôritu Beds?) of the Island of Taiwan.

The occurrence of *Coronula diadema* in fossil state is inte-

(1) S. HANZAWA: Geology and Topography of the Riukiu Islands. Sci. Rep. Tôhoku Imp. Univ. Sendai, Ser. 2. Geol., Vol. 17, 1935.

(2) H. YABE: The Middle and Upper Mizuho Period (Japanese Neogene). Contr. Inst. Geol. a. Palaeont. Tôhoku Imp. Univ. Sendai, Vol. 16, 1935 (in Japanese).

resting in several respects, such as, (1) its presence indicates the former existence of the humpback whale *Megaptera* or its ancestor in the absence of fossil whale bones, (2) its presence in geological formations may aid in throwing some light on the depth of the seas in which sedimentation took place, and another interesting feature is (3) that this species is best represented in the deposits referable to the Lower Pliocene in age, although it is also known to occur in deposits belonging to the Upper Miocene in a two-fold division.

Providing the fossil barnacle now being considered was not pushed up to near the strand line by under-tow currents and that the former whales which act as a host to the barnacle was not able to invade waters as shallow as the strand-line, the following may be reasonable. Of course the question arises as to whether the barnacle was buried at the place of death or in a place remote from the actual place of death. In the fact that the specimen is not water-worn or abraded and well preserved, it seems quite possible if not altogether natural to believe in the category. This data leads in the assumption but not conclusion that the deposits yielding this species in good preservation were laid down in somewhat deep water of the littoral zone and not in the strand line.

From the above, we find that the three species mentioned together with those not remarked upon are important in dealing with the age of a geological complex yielding them. Upon the data now at hand, it seems more reasonable to consider the beds yielding these fossils to be a different facies of the Simaziri Beds and not a part of the Ryûkyû limestone complex. It is only natural to consider the fossil fauna as belonging to the Simaziri Beds upon the absence of knowledge of the stratigraphical relationship existing between the Ryûkyû limestone formation and the beds yielding these fossils.

Furthermore, it seems only natural that the Simaziri Beds should have a limestone facies, and a limestone facies should not always indicate the Ryûkyû limestone formation. Lithic nature alone is often misleading. To be born in mind is the fact that reef-building corals must have existed prior to the building of the Ryûkyû limestone, according to the latitude of the said island.

琉球群島沖縄島の化石海棲フオーナに就いて (摘 要)

野村七平 畑井小虎

辻田幹一氏送附の琉球那覇市附近産化石を検するに、石灰岩を母岩として *Thyasira nipponica*, *Pecten praesignis*, *Coronula diadema* 其の他數種貝類, ウニ等が混在するを知つた。産地の層位關係が不明ではつきりしたことは言ひ兼ねるが上記三種の從來の産出記録に重點を置くならば石灰岩層ではあるが之を所謂琉球石灰岩とするよりむしろ島尻層群(鮮新世)として考へたい。

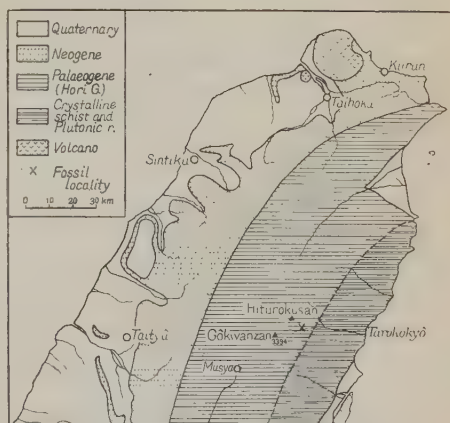
13. A New Fossil-Localty of Eocene Foraminifera in the Upstream of Taroko-kyô, Taiwan

By

HARUYOSI HUZIMOTO & OTOKITI NAGASIMA

(Contribution from the Geological and Mineralogical Institute, Tokyo
Bunrika Daigaku (Tokyo University of Literature and Science))
[Read November 30th 1935; received March 14th, 1936]

In the middle of August, 1935, one of the authors, NAGASIMA, traversed the mountain-range which forms the backbone of Formosa, from the eastern coast (about 18km. to the north of Karenko), along Taroko-kyô (=Takkiri-Kei) westward, across Gôkwanzan-tôge, attaining Musya at last. Then he found a fossil which seems to be the Crinoid-stem (Plate 16(6), fig. 16) in the limestone intercalated in the Hori Group about 1 km. west of the Hituroku Police Station. On investigating the collection which NAGASIMA collected there, HUZIMOTO found fossils of *Camerina* sp. and *Glomospira* sp. (?) in it. According to the field observation, NAGASIMA saw that in the neighbourhood where limestone is distributed containing *Camerina*, there develops an alternation of clayslate and sandstone, and about four layers of limestone 10 m. in thickness at most are found in it, the westernmost layer containing Crinoid fossil, and the easternmost one containing *Camerina* sp. East of the area where these layers of limestone are distributed, green schist about several hundred m. in thickness is found, and forms a striking precipice. To its east, clayslate and sandstone are dis-



tributed again. To the east of the Sekigahara Police Station, about 3 km. west of the fossil-locality, a layer of conglomerate about several hundred meters in thickness is distributed among the layers of clayslate, and the whole is pressed and its pebbles are lenticular. The strata distributed about 4 km. from Sekigahara to Hituroku intercalate the above-mentioned *Camerina* limestone in them and the strike is from south to north and inclination to the east. This clearly corresponds to the Hori Group of Drs. YABE and HANZAWA.⁽¹⁾

The Hori Group consists of the Upper and Lower Clayslate formations, and the former has usually been regarded as Palaeozoic and the latter as Mesozoic.⁽²⁾ MESSRS. YABE and HANZAWA found *Camerina* sp. and *Discocyclus* sp. at Kumanau-sya, Tyôsyû-gun, Takao Prefecture, and *Assilina formosaensis* HANZAWA near the Police Stations in Keinan-zan and Tôzenzan, Heitô-gun, Takao Prefecture, both of them being found in the clayslate formation. Therefore, they named these two formations of clayslate the Hori Group, and concluded its geological age as older than Miocene, and the part containing the above-mentioned foraminifera fossils to be at least representing Eocene. Lately, Dr. HAYASAKA⁽³⁾ has reported that he found *Discocyclus* and *Camerina* in the limestone near the peak of Minami-Daibu in Takao Prefecture.

Our discovery of *Camerina* adds a new proof for the Eocene theory of the Hori Group, thus certifying the theory of Messrs. YABE and HANZAWA. Moreover, it is the more interesting because the locality is far north from the place of discovery of the people above-mentioned.

(1) H. YABE and S. HANZAWA: Tertiary foraminiferous rocks of Taiwan. Sci. Rep. Toh. Imp. Univ. Sendai. 2nd Ser. Vol. XIV, No. 1, 1930.

S. HANZAWA: Notes on some Eocene foraminifera found in Taiwan, etc. Sci. Rep. Toh. Imp. Univ. Sendai. 2nd Ser. Vol. XII, No. 2, A. 1931.

H. YABE: Japanese Tertiary Rocks with Higher Foraminifera (in Japanese). Jour. Geol. Soc. Tokyo, Vol. XXVII, No. 318, 1920.

(2) Geological Map of Taiwan and its Explanatory Text. 1926, Geological Survey of Japan: Geology and Mineral Resource of Japan. 1932.

(3) I. HAYASAKA: A *Discocyclus*-Limestone exposed near the peak of Minami-Daibu in Takao Prefecture, Taiwan. Proc. Imp. Acad. Tôkyô. Vol. XI. 1935.

Camerina BRUGIÈRE, 1792. (= *Nummulites* LAMARCK, 1801)

Camerina sp.

Plate 16 (6), Figs. 1-11.

Test small lenticular, planispiral, bilaterally symmetrical, involute. Test, ca. 1.2mm. in diameter and ca. 0.8mm. in thickness, is composed of about 5 volutions. Septa rather thick ca. ab 0.016mm. in the fifth volution, curving gradually backward approaching the periphery. There are about 22 septa in the fifth volution. The present species specifically indeterminable, but more or less resembles *Nummulites* sp.⁽¹⁾ from Amakusa-sima.

Horizon: Eocene.

Explanation of Plate 16 (6)

Figs. 1-11. *Camerina* sp.

Figs. 1-4. Sagittal sections. $\times 20$. Loc. about 1km west of the Hituroku Police Station, Karenko-tyô.

Figs. 5-7. Axial sections. $\times 20$. Loc. ditto.

Figs. 8-11. Excentric sections. $\times 20$. Loc. ditto.

Figs. 12-15. *Glomospira* sp.? $\times 20$. Loc. ditto.

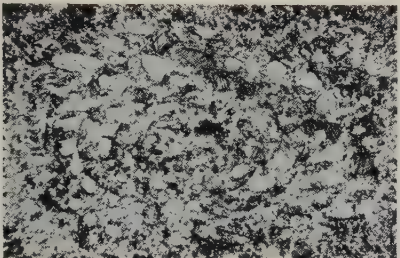
Fig. 16. Weathered surface of the crinoid limestone. $\times \frac{1}{1.7}$. Loc. ditto.

13. 臺灣太魯閣峽上流に於ける始新世化石の新産地 (摘要)

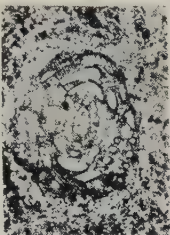
藤本 治義 長島 乙吉

昭和十年八月長島は臺灣の東岸より太魯閣峽に沿つて西方へ合歡山峠を越へて春稜山脈を横斷した。其際畢祿巡査駐在所の西方約 1km の地點にて埔里層に夾在される石灰岩に海百合の莖と思はれる化石を發見した。其後長島が此附近で採集せる材料につき藤本の粗査せる處其の中に *Camerina* sp., *Glomospira* sp.? 等の化石を發見した。此の *Camerina* 石灰岩は粘板岩及砂岩の互層中に夾在され、此等の地層は矢部教授と半澤理學士の埔里層と稱せるものに相當し、又古く下部粘板岩系とされてゐたものに當る。矢部教授と半澤理學士は南部の高雄州で此の埔里層中から *Camerina* sp. 其他の始新世の標準化石を發見され埔里層の地質時代を中新世より古く、化石を含有する部分は始新世とされた。筆者等の *Camerina* sp. の發見は此の埔里層の始新世説を證據立てる一新事實を加へたことになる。

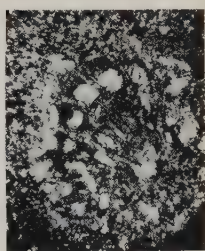
(1) YABE and HANZAWA: Nummulitic rocks of the Islands of Amakusa. Sci. Rep. Toh. Imp. Univ. 2nd Ser., Vol. VII, No. 3, pp. 79, 80, Pl. XVIII, fig. 6, Pl. XXI, fig. 7.



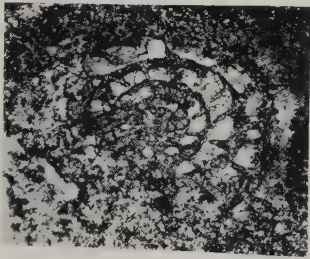
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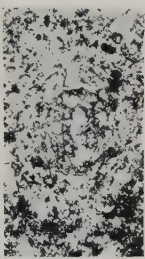
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8



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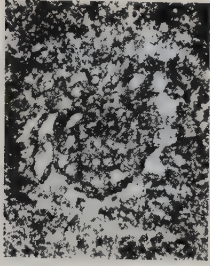
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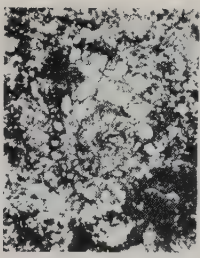
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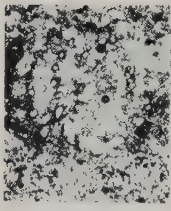
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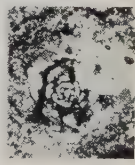
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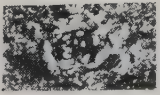
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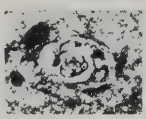
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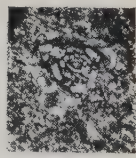
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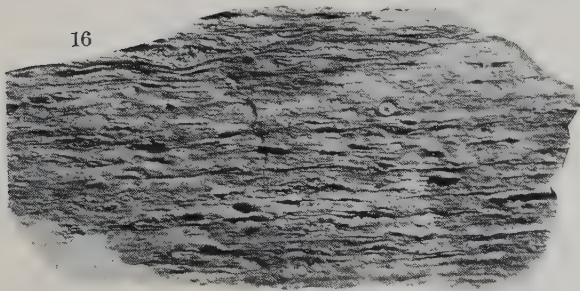


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14

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16

14. *On the Devonian Equator Located by the Growth Rate of Tetracorals*

By

TING YING H. MA

(Contribution from the Institute of Geology and Palaeontology,
Tôhoku Imperial University, Sendai, Japan.)
[Received and read February 29th, 1936.]

I measured the growth rate of Devonian Tetracorals stored in our Institute of Geology and Palaeontology, Tohoku Imperial University, Sendai and also those figured by some authors⁽¹⁾; and the result is shown in an annexed table (Pl. 18 (7)).

Discussion and Summary

In the recent reef building corals the annual length of growth of corallum or corallites in the same species or in the same genus is longer in warmer places where the animals lived; this may have also been true in the case of Palaeozoic corals. The water temperature in the Eurasian Continent as is indicated by the Devonian Tetracorals, and based upon the facts cited above, may have been warmest along the zone combining the districts of Timan and Ural, Northern Russia and the provinces of Szechuan and Yunnan, Southern China. Measurement of the forms in the genera *Thamnophyllum*, *Prismatophyllum*, *Endophyllum*, *Ceratophyllum*, *Keriophyllum*, *Dohmophyllum* as well as *Diplochone* together with *Cystiphyllum* indicate that the temperature of Devonian seas of Germany and France as well as England may have been much colder than those cited above and Padaukpin of Shan States, Kusnetzki of Siberia. From the measurements of the same species or the forms of *Thamnophyllum*, *Endophyllum* and *Cystiphyllum* it is assumed that the temperature of the Devonian sea of England may have been more or less warmer than those of

(1) Full details will appear in *Palaeontologia Sinica*, Ser. B, Vol. II, Fasc. 3, under the article "On the Seasonal Growth in Palaeozoic Tetracorals and the Climate during the Devonian Period."

Germany and France, and that, that of Graz in Austria may have been somewhat colder than that of Germany; from those of *Prismatophyllum hexagonum* (GOLDFUSS) and *Ceratophyllum ceratites* (GOLDFUSS) it seems that the temperature of the Devonian sea of France may have been more or less warmer than that of Germany. From the development of the seasonal change of growth in the forms of *Thamnophyllum*, *Ptenophyllum* and *Dialytophyllum* together with *Mesophyllum* it is assumed that the temperature of the Devonian seas of Anatolia and Turan of Asia Minor may have been much colder than that of Germany; from that of *Dohmophyllum tinocystis* (FRECH) and its variety that the temperature of Italian sea during that time may have been colder than that in Germany. The development of the seasonal change of growth in *Campophyllum lindstroemi* (FRECH) and *Keriophyllum heterophylloides* (FRECH) indicated that the temperature of sea water of Hunan and Kwangsi of Southern China in that time may have been much warmer than that of Germany. From the measurements of the forms of *Prismatophyllum*, *Pachyphyllum*, *Tabulophyllum* and *Campophyllum* as well as *Cystiphyllum* it seems that the temperature of the Devonian seas of Iowa, Illinois and Missouri States of North America may have been neither colder nor so much warmer than that of Germany; from those of *Cystiphyllum* and *Keriophyllum* it is assumed that the temperature of the sea water of New York and Maryland States of North America may have been much warmer than that of Missouri as well as Germany during that time; and from that of *Tabulophyllum ellipticum* (HALL and WHITFIELD) it seems that the temperature of the Devonian sea in Mackenzie River Basin may have been much colder than that of Missouri State of North America.

These above mentioned data, advanced one step more, leads to the following inference.

Devonian Equator

This complicated subject cannot be discussed in the connection without drawing a rough map from the evidence cited above. As it was seen in the table the phenomenon of the seasonal change of growth is quite wanting or very feeble in development in the fossils from Timan and Ural in Northern Russia and Szechuan

and Yunnan in China, this is highly important and equally interesting as it probably indicated that the equator of the earth during the Devonian period may have passed near the districts just mentioned. It seems reasonable to assume that the positions of the fossil localities may have more or less migrated by later crustal movements of the earth and that the isothermal lines may have been, as at present-day, greatly influenced by various geographical conditions. From available data it follows that the equator may have, in the most probability, taken the course shown in the accompanying map during that time at the Eurasian Continent. Proving that this is allowed, then the North American Continent may have been nearer to the Eurasian Continent at that time than at present. Another important evidence which should be given is that the water temperature of the Devonian seas of New York and Maryland States of North America may have been much warmer than those of Missouri and Germany, and that the sea water of Germany may have never been much colder than those of Iowa, Illinois and Missouri. This lead the author to assume that the North American Continent may have never been in contact with Eurasia during the Devonian period as imagined by A. WEGENER.⁽¹⁾

Devonian reef corals also occur in Australia and the seasonal change of growth in *Cystiphyllum* and *Grypophyllum* indicates that the Devonian sea of Queensland may have never been colder than that of Germany, but materials are insufficient to demonstrate whether or not the continent occupied its present position during the Devonian period.

At last the author wishes to express his sincere thanks to Professor H. YABE under whose kind guidance this work was carried out. Thanks are also due to Mr. Y. S. CHI, geologist and palaeontologist of the Geology Servey of China, for sending photographs of the Devonian corals collected by himself from Central China; and to Mr. KOTORA M. HATAI for his help in English.

(1) KÖPPEN und WEGENER: Die Klimate der geologischen Vorzeit, pp. 141-144, fig. 21, 1924.

Explanation of Plate 19 (8)

—Devonian Equator in Eurasian Continent and its prolongation. ◎Position of pole in Devonian period. 1. Fossil locality of England. 2 and 3. Fossil localities of France. 4 and 5. Fossil localities of Germany. 6. Graz of Austria. 7. Fossil locality of Italy. 8. Anatolia of Asia Minor. 9. Turan in Asia Minor. 10. Western slope of Ural in Northern Russia. 11. Timan of Northern Russia. 12. Eastern slope of Ural in Northern Russia. 13. Kusnetz of Siberia. 14. Province Szechuan of China. 15. Province Yunan of Southern China. 16. Province Hunan of Central China. 17. Province Kwangsi of Southern China. 18. Padaukpin of Northern Shan States. 19. North Central Iowa of North America. 20. Illinois State of North America. 21. Missouri of North America. 22. New York State of North America. 23. Maryland State of North America. 24. Mackenzie River Basin of Canada in North America. 25. Queensland of Australia.

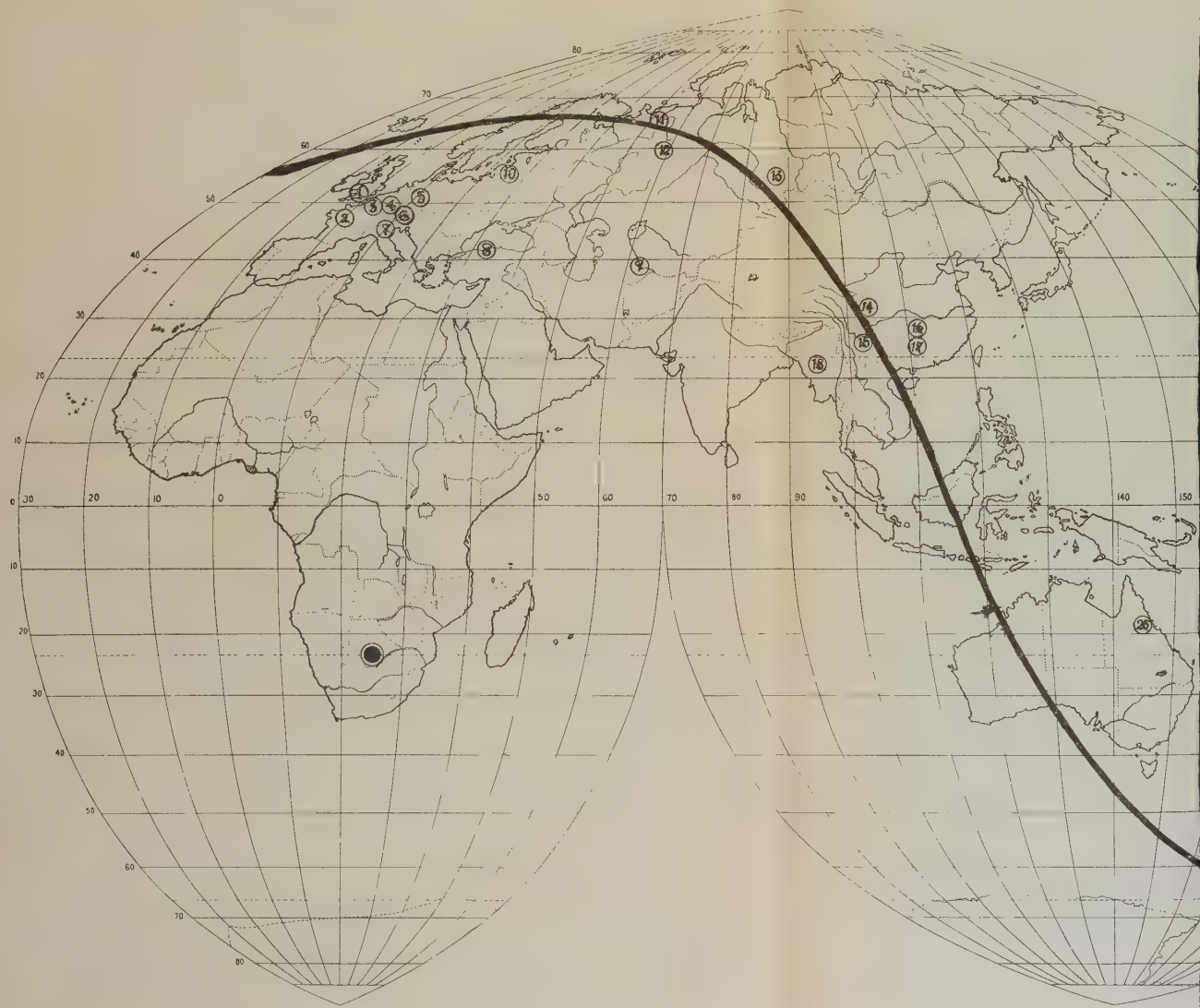
11. 四射珊瑚の成長率より推定されたる泥盆紀の赤道 (摘要)

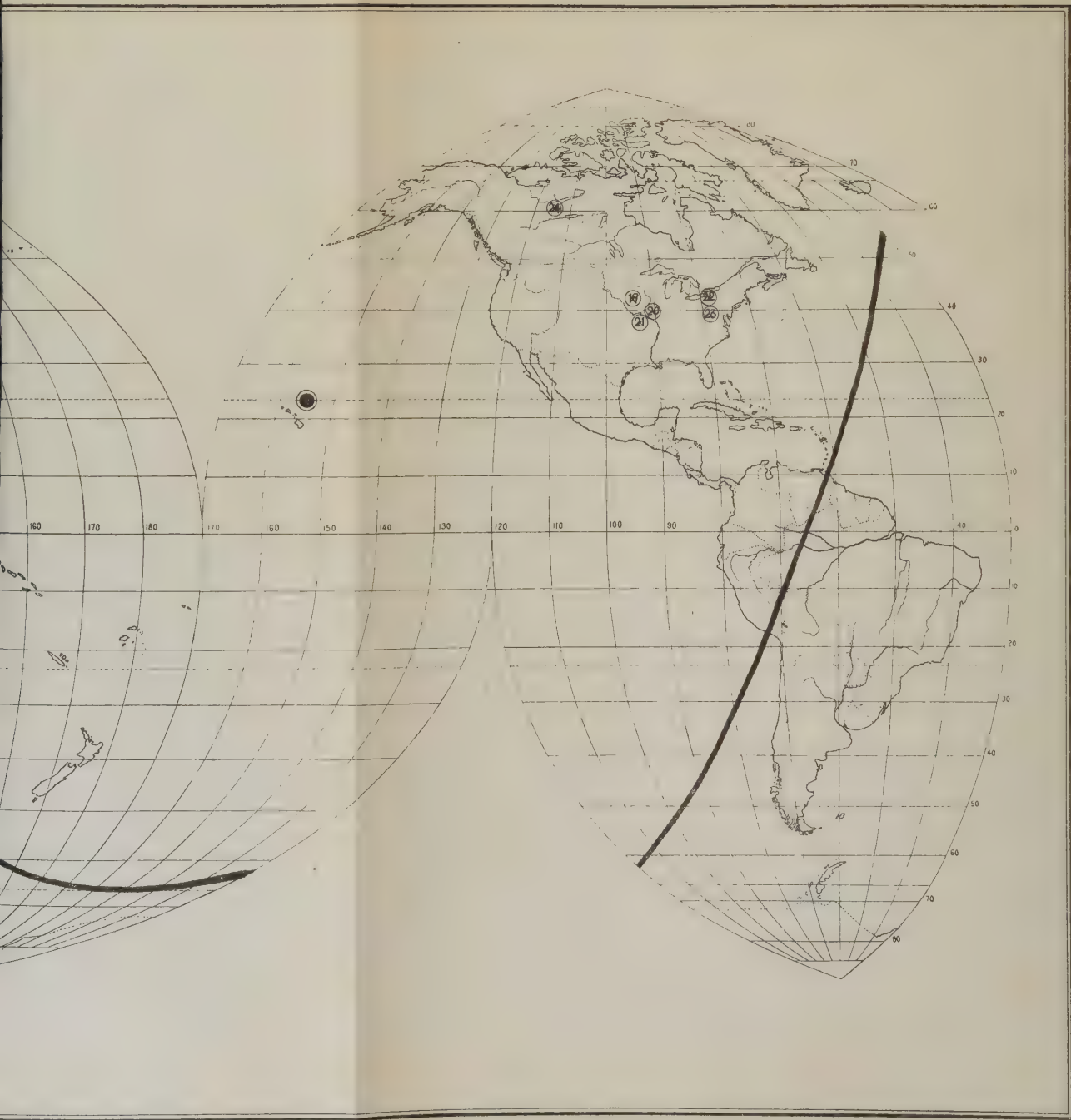
馬 廷 英

現代造礁珊瑚の成長率は水温に對し、一定の關係を有し水温の増高につれ成長率が速い即ち高温地方に於ける年成長は低温地方より長いことは筆者によつて發見された所である。同種又は同屬の各地又は各國の成長の長短より泥盆紀の氣候を推想し尙一步進み其の時代に於ける歐亞大陸の赤道區域を尋出し出來得んば大陸移動の是非を判斷しようと思ふ。

	ENGLAND	FRANCE	GERMANY	AUSTRIA	POLAND	ITALY	R U S S I A				
				Graz		Collina	W Ural	E Ural	Timan	Kusnetz	
1. Genus THAMNOPHYLLUM PENCKE				4.00(3)							
2. <i>Thamnophyllum stuckei</i> PENCKE											
3. <i>Thamnophyllum cespitosum</i> (GOLDFUSS)	36.00mm.(1) ¹⁴	10.00(1)	6.36(1)						None(1)		
4. <i>Thamnophyllum carbonicum</i> (LEBDEW)			5.50(2)						12.00(1)		
5. <i>Thamnophyllum minus</i> (BOERMA)			6.25(2)		6.00(1)				None(3)		
6. <i>Thamnophyllum kunthi</i> (DAMES)			4.50(2)						None(1)	*	
7. <i>Thamnophyllum supradeticum</i> PENCKE			5.75(2)								
11. Genus PRISMATOPHYLLUM SIMPSON											
8. <i>Prismatophyllum hexagonum</i> (GOLDFUSS)		8.00(1)	6.25(2)								
9. <i>Prismatophyllum darwini</i> (FRENCH)			None(1)								
10. <i>Prismatophyllum edgwicki</i> (E. & H.)									None(1)		
11. <i>Prismatophyllum goldfussi</i> (E. & H.)			4.60(2)						None(1)		
12. <i>Prismatophyllum pentagonum</i> (GOLDFUSS)			5.50(2)								
13. <i>P. pentagonum</i> var. <i>micrommata</i> (BOERMA)			2.40(1)								
14. <i>Prismatophyllum douvillei</i> (FRENCH)											
15. <i>P. douvillei</i> var. <i>sinensis</i> (Y. & H.)											
III. Genus PACHYPHYLLUM E. & H.											
16. <i>Pachyphyllum deconense</i> E. & H.			5.00(1)								
17. <i>Pachyphyllum ibergense</i> (BOERMA)			6.00(1)								
18. <i>Pachyphyllum woodmani</i> (WHITE)											
19. <i>Pachyphyllum crassicastrum</i> WESTER											
20a. <i>P. crassicastrum</i> var. <i>acutum</i> FENTON											
IV. Genus CAMPOPHYLLUM E. & H.											
21. <i>Campophyllum lindstroemi</i> (FRENCH)			10.21(7)								
22. <i>C. lindstroemi</i> var. <i>clavata</i> (FENTON)											
23. <i>Campophyllum annulatum</i> (PELLE)											
24. <i>Campophyllum dunhuui</i> (GOLDFUSS)			10.30(5)							5.00(1)	
V. Genus ENDOPHYLLUM E. & H.											
25. <i>Endophyllum boerbanki</i> E. & H.	5.00(1)		4.75(2)								
26. <i>Endophyllum abditum</i> E. & H.	6.00(1)										
27. <i>Endophyllum uehleri</i> (LEBDEW)									19.50(2)		
28. <i>Endophyllum keuperlingi</i> (LEBDEW)									15.00(1)		
VI. Genus TABULOPHYLLUM FENTON											
29. <i>Tabulophyllum rectum</i> FENTON											
30. <i>Tabulophyllum rotundum</i> FENTON											
31. <i>Tabulophyllum manum</i> FENTON											
32. <i>Tabulophyllum ponderosum</i> FENTON											
33. <i>Tabulophyllum robustum</i> FENTON											
34. <i>Tabulophyllum ellipticum</i> (H. & W.)											
35. <i>Tabulophyllum callawayense</i> (BRANSON)											
36. <i>Tabulophyllum praeum</i> (FRENCH)			7.00(1)								
37. <i>Tabulophyllum tenuissimum</i> (WALTHER)			11.00(1)								
38. <i>Tabulophyllum hartoni</i> (CHARLES)											
39. <i>Tabulophyllum nicolai-nichailidis</i> (FRENCH)											
40. <i>Tabulophyllum yunnanense</i> (REED)											
41. <i>Tabulophyllum birmanicum</i> (REED)											
VII. Genus CERATOPHYLLUM GÜBICH											
42. <i>Ceratophyllum ceratites</i> (GOLDFUSS)		5.50(1)	4.00(7)						11.33(3)		
VIII. Genus GRYPHOPHYLLUM WEDERKIND											
43. <i>Grypophyllum gracile</i> WEDERKIND			4.25(2)						10.00(1)		
44. <i>Grypophyllum normale</i> WEDERKIND			5.40(1)								
45. <i>Grypophyllum tamaricum</i> (LEBDEW)									13.00(1)		
46. <i>Grypophyllum</i> sp.									20.00(1)		
47. <i>Grypophyllum</i> sp.											
IX. Genus SPONGOPHYLLUM E. & H.											
48. <i>Spongophyllum stuckenbergi</i> (LEBDEW)											
49. <i>Spongophyllum elongatum</i> SCHLÜTER			7.50(1)						None(1)		
50. <i>Spongophyllum kunthi</i> SCHLÜTER			6.00(2)								
51. <i>Spongophyllum semiseptatum</i> SCHLÜTER			10.00(1)								
X. Genus PTENOPHYLLUM WEDERKIND											
52. <i>Ptenophyllum verruculaceum</i> (GOLDFUSS)			10.00(3)								
53. <i>P. verruculaceum</i> mut. <i>procurator</i> (FRENCH)			9.00(2)								
54. <i>Ptenophyllum heterophyllum</i> (E. & H.)			5.75(10)								
XI. Genus KERIOPHYLLUM WEDERKIND											
55. <i>Keriophyllum heterophylloides</i> (FRENCH)			5.00(1)								
56. <i>Keriophyllum proliferum</i> (FRENCH)			2.00(1)								
57. <i>Keriophyllum</i> sp.			3.00(1)								
XII. Genus DOHMOPHYLLUM WEDERKIND											
58. <i>Dohmophyllum tinocyste</i> (FRENCH)			7.50(2)								
59. <i>D. tinocyste</i> var. <i>curvica</i> (VINASSA)						8.50(1)					
60. <i>Dohmophyllum helianthoides</i> (GOLDFUSS)			5.50(1)	*							
61. <i>D. helianthoides</i> var. <i>spinulosum</i> (REED)											
62. <i>Dohmophyllum involutum</i> WEDERKIND			4.00(1)								
XIII. Genus DIALYTOPHYLLUM AMANSHAUSER											
63. <i>Dialytophyllum simplex</i> AMANSHAUSER			4.00(1)								
64. <i>Dialytophyllum cylindricum</i> (SCHLÜTER)			7.00(3)								
65. <i>Dialytophyllum multiseptatum</i> MA			7.00(1)								
66. <i>Dialytophyllum pseudoheteraceras</i> (SCHLÜTER)			11.00(2)								
67. <i>Dialytophyllum complicitum</i> AMANSHAUSER											
68. <i>Dialytophyllum goldfussi</i> (E. & H.)			9.50(2)								
XIV. Genus MESOPHYLLUM SCHLÜTER											
69. <i>Mesophyllum nazium</i> SCHLÜTER			8.02(5)								
70. <i>Mesophyllum defectum</i> SCHLÜTER							15.00(1)				
71. <i>Mesophyllum parvum</i> (MARKOV)							12.00(1)				
72. <i>Mesophyllum</i> sp.			7.00(1)								
XV. Genus DIPLOCHONE FRENCH											
73. <i>Diplochone striata</i> FRENCH			9.00(1)								
74. <i>Diplochone amplexoides</i> TCHERNYSCHEW								25.00(1)			
75. <i>Diplochone intermedia</i> TCHERNYSCHEW								15.00(1)			
XVI. Genus CYSTIPHYLLUM LONSDALE											
76. <i>Cystiphyllum pseudoseptatum</i> SCHULZ	5.50(2)		4.18(4)								
77. <i>Cystiphyllum venenosum</i> (GOLDFUSS)			6.17(17)				13.00(1)			8.00(1)	
78. <i>Cystiphyllum salicicum</i> PELTZ										12.25(2)	
79. <i>Cystiphyllum westerauwii</i> (PELTZ)										15.00(1)	
80. <i>Cystiphyllum cristatum</i> FRENCH			13.50(1)					None(1)			
81. <i>Cystiphyllum fasciculatum</i> SWARTZ											
82. <i>Cystiphyllum</i> var. <i>affinis</i> HALL											









15. *Pseudononion*, a New Genus of Foraminifera found in Muraoka-mura, Kamakura-gôri, Kanagawa Prefecture

By

KIYOSI ASANO

(Contribution from the Inst. of Geol. and Palaeont., Tôhoku Imp.
Univ., Sendai, Japan)

[Read February 29th, 1936; received April 4th, 1936]

In a recent study of the fossil foraminifera from Muraoka-mura, Kamakura-gôri, Kanagawa Pref., the following new genus has been found.

Genus ***Pseudononion*** ASANO, n. gen.

Genoholotype, *Pseudononion japonicum* ASANO, n. sp.

Test free, bilaterally asymmetrical, dorsal side partially involute, leaving previous whorls uncovered, ventral side completely involute, having no elongate lobe at the umbilicus; chambers numerous, earlier ones only visible on one side of test; wall calcareous, finely perforate; aperture a narrow slit at base of apertural face.

Pliocene-Recent.

This new genus was derived from a planispirally involute form, probably *Nonion*⁽¹⁾, by an asymmetrical arrangement of the later chambers; already in *Nonionella*⁽²⁾, a distinct, elongate lobe is developed at the umbilicus on the ventral side of the test. It is now represented by a single species *P. japonicum*, the genotype which is common in the Late Tertiary and Recent materials of Japan.

Pseudononion japonicum ASANO, n. sp.

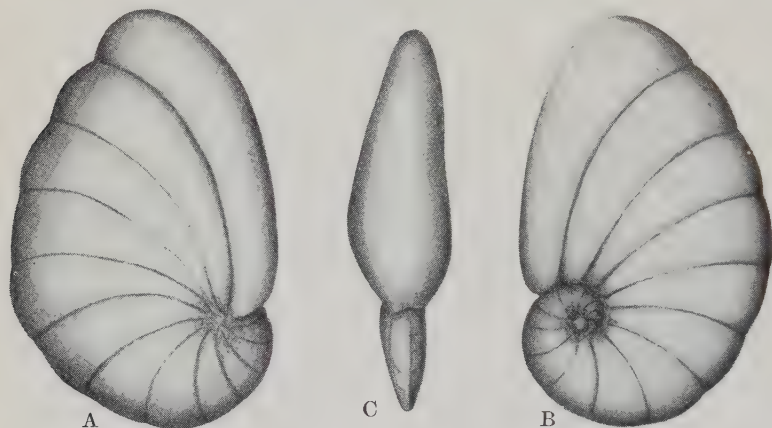
Test asymmetrical, depressed, dorsal side slightly convex with all coils visible, ventral side with only the last-formed coil visible, periphery subacute; chambers distinct, 10 to 12 in adult, having no elongate lobe extending over the umbilicus on the ventral side; sutures distinct, slightly depressed, gently curved; wall finely perforate; aperture a narrow slit

1), 2) Cushman; Foraminifera, Their Classification and Economic Use, 2nd Ed 1933, p. 192.

at the base of the apertural face.

Length 0.40 mm.; breadth 0.25 mm.; thickness 0.1 mm.

Holotype (Inst. Geol. & Pal., Tôhoku Imp. Univ., Reg. No. 21362) from Muraoka-mura, Kamakura-gôri, Kanagawa-Pref.



Pseudononion japonicum n. sp. $\times 60$.
A. Ventral view B. Dorsal view C. Apertural view

15. 有孔蟲一新屬 *Pseudononion* (摘要)

浅 野 清

神奈川県鎌倉郡村岡村産化石有孔蟲研究の結果、8 種の新種を發見、此等の記載は、別報に於て提唱せんとするも、その中の 1 種は、既に記載されたる如何なる屬にも所屬せざることを知れり。依つて此種の爲に新屬 *Pseudononion* を樹立し、*Pseudononion japonicum* ASANO を以つて模式種とす。茲に其の新屬、模式種を記載し、其の屬の含るべき Nonionidae 科中の位置を論じたものである。

16. *The World-Wide Distribution of the Ribeirioid in the Ordovician Period*

By

TEIICHI KOBAYASHI

(Contribution from the Geol. Inst., Imp. Univ. Tokyo.)

[Read on April 3rd, 1936 ; received on April 6th, 1936]

1. Nomenclature and Taxonomic Position.
2. *Technophorus* and *Ribeirella*.
3. *Ribeiria* (?) *prosseri* CLARKE.
4. *Technophorus* from South America.
5. The Lower and Middle Cambrian progenitor of the Ribeirioid.
6. Geological and Geographical Distribution of the Eopteridae.
7. As to the Migration and Evolution of the Cambro-Ordovician Life.
8. Acknowledgement.

1. *Nomenclature and Taxonomic Position*:—Since a revision on this problematicum had been presented in my previous paper⁽¹⁾, a new genus, *Tolmachovia*, was established by HOWELL and myself⁽²⁾ with *Tolmachovia concentrica* HOWELL and KOBAYASHI as the genotype. The family name, Ribeiridae, is replaced here by the Eopteridae MILLER⁽³⁾ on account of priority. The choice between the Eopteridae and Technophoridae which were established by the same author likewise is simply based on the reason that the former name stands prior to the latter.

No substantial argument as to the taxonomic position of the group has been advanced except for SCHUBERT and WAAGEN's comparison⁽⁴⁾ of *Ribeiria* to *Apus* which most palaeontologists are following now. *Apus* may be the nearest animal now we can think of, but *Ribeiria* is still quite distinct from *Apus* in the folding of carapace and absence of posterior truncation. On the other

(1) T. KOBAYASHI (1933), Faunal Study of the Wanwanian (Basal Ordovician) Series with Special Notes on the Ribeiridae and the Ellesmereoceroids, (Jour. Fac. Sci., Imp. Univ. Tokyo, Sect. II, Vol. III, Pt. 7.)

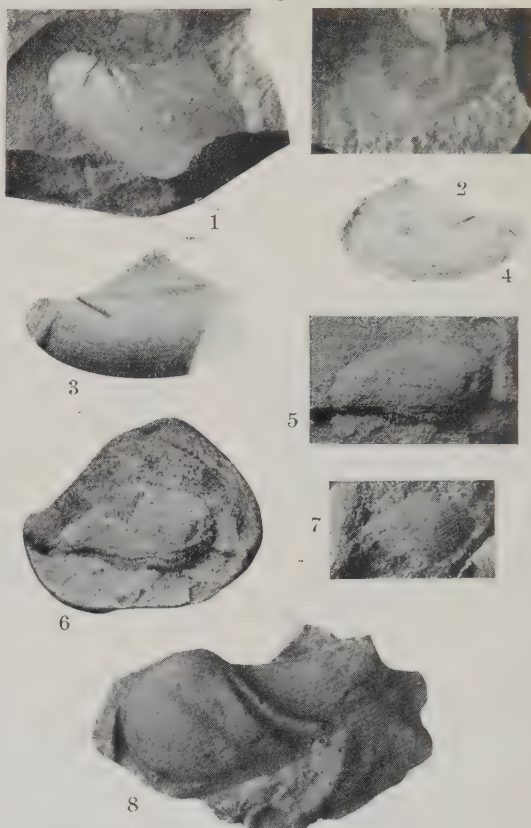
(2) B. F. HOWELL and T. KOBAYASHI (1936) A New Notostracan Genus from the Ordovician of Siberia, (Ann. Carnegie Mus. Vol. XXV.)

(3) S. A. MILLER (1889), North American Geology and Palaeontology, p. 458.

(4) R. J. SCHUBERT and I. WAAGEN (1903), Die untersilurischen Phyllopodengattungen *Ribeiria* SHARPE and *Ribeirella*, nov. gen., (Jahrb. k. k. geol. Reichsanstalt. Bd. LII.)

hand the Eopteridae is a solid family in itself. The calcareous carapace and the concentric or radial marking on the surface are the additional natures of significance.

2) *Ribeirella* and *Technophorus*:—In BASSLER's Index⁽¹⁾ *Ribeirella* is considered a synonym of *Technophorus*⁽²⁾, but there are some differences which can hardly be overlooked. In *Technophorus* (fig. 8) the keel is very strong and frequently grooved along the middle, and behind it a large wing is produced back, while in *Ribeirella* the keel is running close to the postero-dorsal margin. Internally the anterior clavicle is vertical and strong, but neither clavicle nor callosity appears behind the beak in *Technophorus* whereas in *Ribeirella* there is some callosity of moderate strength behind the beak and it is united with anterior clavicle by a concentric ridge. By the nature of its single clavicle *Technophorus*



Schizopeecten prosseri (CLARKE)

Figs. 1-2. Photographs from the type specimens in the New York State Museum at Albany, N. Y.

Figs. 3-4. Reproductions from the CLARKE's illustrations of *Ribeiria* ? *prosseri*.

Technophorus otaviensis KOBAYASHI (nov.)

Figs. 5-7. Types kept in the Geol. Inst., University at Freiburg i. Br.

Technophorus faberi MILLER

Fig. 8. Photograph from the type specimen kept in the U. S. National Museum at Washington, D. C

(1) R. S. BASSLER (1915), Bibliographic Index of American Ordovician and Silurian Fossils, (U. S. Nat. Mus. Bull. 92), p. 1257.

(2) E. O. ULRICH (1892), New Lower Silurian Lamellibranchiata chiefly from Minnesota Rocks, (19th Ann. Rep. Geol. Nat. Hist. Surv. Minn.)

should be excepted from the Ischyriinae.

It may be true, however, that *Ribeirella* merges in some characters into *Technophorus* on one hand and into *Ribeiria* on the other which in turn approaches *Wanwania*.

Finally, it is noted that in my observation upon the type in the U.S. National Museum *Technophorus ? yoldiformis* (ULRICH)⁽¹⁾ has two adductor scars which are connected by a simple pallial line. Further, the anterior clavicle is very weak and the carination is quite unlike the *Technophorus* type. This is in my belief undoubtedly a pelecypod, probably belonging to *Nuculites* or its allied genus, as once referred by ULRICH himself.⁽²⁾

3. *Ribeiria ? prosseri* CLARKE:—Shell very thin and slightly convex; hinge margin V-shaped with an angle of 150 degrees at the beak; rest of the margin somewhat ovately elliptical, expanded backward; two ribs on the surface, the anterior one close to the anterior hinge margin, and posterior one in the same line with that margin and marking off a large wing whose posterior edge is slightly sinuated as in *Aviculopecten*; surface ornamented by weak concentric lines of growth.

Internally two narrow and short ridges diverge from the beak; the anterior one close to and inside of the anterior rib; the posterior one stronger and coursing inside of the posterior rib with an angle of about 30 degrees between; along the hinge margin a narrow groove runs as commonly seen in the Pectinidae.

As the cotypes are depressed to some extent, the original convexity of the valves cannot be figured out. In one cotype a radial groove is observed, dividing the angle between the posterior rib and internal ridge, but we cannot be sure whether or not, this is the original feature, because no trace of the groove is seen in the juxtaposition of the another cotype which is less deformed.

The hinge groove alludes to the fact that the shell had been hinged with another along the margin. The V-shape of the hinge margin is uncommon in pelecypods, but it is instead found in *Entolium*. The pair of internal ridges might be compared

(1) E. O. ULRICH (1879) Jour. Cincinnati Soc. Nat. Hist. 2, p. 24, pl. 7 fig. 20.

(2) E. O. ULRICH (1893), New and Little known Lamellibranchiata from the Lower Silurian Rocks of Ohio and Adjacent States, (Geol. Surv. Ohio. Vol. VII.) p. 685, pl. 47, figs. 13-14.

with those of *Amusium*. Although it is very vaguely represented, there is a round spot impressed inside of the anterior rib, and if this spot is a trace of the adductor scar, it might be monomyarian.

CLARKE⁽¹⁾ provisionally compared this species to *Technophorus* and *Ribeiria*, but for the first place it is neither a *Technophorus* nor a *Ribeiria* without question, because the external and internal aspects are quite different from either one of them. Because of the aspect of the hinge this species cannot be included in the Eopteridae.

The chance may be among the bivalved crustaceans. As no trace of the irregular striation across the concentric ribs and interspaces can be seen at all, *Estheria* is out of the comparison. In the outline *Leaia* JONES and *Schizodiscus* CLARKE non. KITTL are not unlike this form, but the radial ribs of *Leaia* are sharp and tuberculated and the concentric ribs of *Schizodiscus* acutely roof-shaped. The present form has some concentric folds, but they are nothing like these concentrics of *Schizodiscus*. Thus, I failed to find any sufficient reason to bring this form into the Crustacea.

On the other hand the essential characters, external and internal, are comparable to those of the monomyarian pelecypod, such as Pteriidae and Pectinidae, but the outline, especially the V-shaped hinge margin and two keels are significant natures through which this form fails to fit into any described genus. Therefore, taking *Ribeiria* ? *prosseri* (figs. 1-4) for the genotype, here is established a new genus *Schizopecten*.

4) *Technophorus* from South America:—In the revision on the Cambro-Ordovician material from South America studied by HOEK I found a *Technophorus* collected from a late Middle (?) Ordovician sandstone of Otavi, Bolivia, which is described as follows:—

***Technophorus otaviensis*, new species.**

Figures 6-7

Carapace semi-circular in the anterior half and subtriangular in the posterior; umbo located at about one-third from the anterior end; obtuse plication running along the postero-dorsal margin at a short distance from it; basal margin gently situated in front of the plication; surface marked by concentric ribs.

(1) J. M. CLARKE (1904), Naples Fauna in western New York, (Mem. N. Y. State Museum 6), p. 406, expl. pl.

This is quite distinct from the multiplicate forms or those with a median groove on the plication as *Technophorus su¹acutus* ULRICH,⁽¹⁾ *T. plicata*, (BILLINGS),⁽²⁾ and *T. punctostriatus* ULRICH var. *quincucialis* FOERSTE.⁽³⁾ The plication is not so sharply elevated as in *T. divaricatus* ULRICH and *T. filistriatus* ULRICH,⁽⁴⁾ nor is it provided with a groove on each side as *T. faberi* MILLER.⁽⁵⁾ The concentric ribs vary their strength according to individuals, but none are cancellated as *T. cancellatus* RUEDEMANN.⁽⁶⁾ *T. extenuatus* ULRICH⁽⁷⁾ is distinct from this by the acute bend of the posterior outline. These distinctions indicate that this species is a new one.

5. *The Lower and Middle Cambrian progenitor of the Eopteridae*.—None of the Notostracan genera known from the Burgess shale reveals close similarity to the ribeirioid. *Shafferia* WALCOTT⁽⁸⁾ (*Shafferia cisina* WALCOTT; Lower Cambrian of British Columbia) has a folded carapace in which respect it is allied to the ribeirioid. It has, however, a deep notch and its test has irregular ridges which are never seen in the Eopteridae. WALCOTT suggested its similarity to *Burgessia* and at the same time noted the distinction in the thick test with the characteristic surface marking.

Heraultia⁽⁹⁾ is grouped with *Stenotheca* in an unnamed family of the Notostraca by COBBOLD. *Stenotheca* itself is a problematicum referred variously to Gastropoda, Pteropoda, or Phyllopoda. It is widely distributed in the Lower and Middle Cambrian of North America (British Columbia, New York, Mass., Quebec, New Brus-

(1) E. O. ULRICH (1897), The Lower Silurian Lamellibranchiata of Minnesota, (Geol. Minn. Vol. III, Pt. II.) p. 614, pl. XL, figs. 30-34.

(2) W. T. TWENHOPEL (1928), Geology of Anticosti Island, (Mem. Geol. Surv. Ottawa, 154), p. 340, pl. XVI, fig. 8.

(3) A. F. FOERSTE (1914), Notes on the Lorraine Faunas of New York and the Province of Quebec, (Bull. Sci. Lab. Denison Univ. Vol. XVII), p. 316, pl. II, figs. 13a-b.

(4) ULRICH (1897), Op. cit. p. 615, pl. XL, figs. 35-36; p. 611, pl. XL, figs. 37-38.

(5) S. A. MILLER (1889), North American Geology and Paleontology. p. 514, fig. 930.

(6) R. RUEDEMANN (1901), Hudson River Beds near Albany etc. (Bull. N. Y. State Mus. Vol. 42), p. 572, pl. I, figs. 19-25.

(7) ULRICH (1897), Op. cit. p. 614, pl. XXXVII, fig. 34.

(8) C. D. WALCOTT (1917), Fauna of the Mount Whyte Formation, (Smiths. Misc. Coll. Vol. 67, No. 3), pp. 71-72, pl. 13, figs. 2, 2a.

(9) E. S. COBBOLD (1935), Lower Cambrian Faunas from Herault, France, (Ann. Mag. Nat. Hist., Ser. 10, Vol. XVI), pp. 37-38, pl. II, figs. 1-10.

wick and Newfoundland) and northern Europe (England and Sweden). A dubious one from the Wanwanian of South Manchuria and another from the Black River of Wisconsin are exceptions. Through the renewed study on the genotype, *Stenotheca cornucopia* SALTER, COBBOLD⁽¹⁾ placed it provisionally in the Notostraca in 1934 and subsequently in 1935 he tied up the following four in a group (the genotypes and geological and geographical distributions are cited in brackets):—

Pseudotheca REDLICH, 1901. (*Stenotheca rugosa aspera* NOETLING i. e. *Pseudotheca waageni* REDLICH; Middle Cambrian of India.)

Lapworthella COBBOLD, 1920. (*Lapworthella nigra* COBBOLD; Late Lower Cambrian of Comley in England and (?) Middle Cambrian of Kashmir.)

Heraultia COBBOLD, 1935. (*Heraultia varcaulensis* COBBOLD; Lower Cambrian of Herault, Southern France.)

Stenothecopsis COBBOLD, 1935. (*Stenothecopsis heraultensis* COBBOLD; Lower Cambrian of Herault, South France.)

Further the following two are regarded to be suggestive of some relationship to this group:—

Watsonella GRABAU, 1900. (*Watsonella crosbyi* GRABAU; Lower Cambrian of Boston Basin.)

Helcionella GRABAU and SHIMER, 1909. (*Metoptoma?* *rugosa* HALL; Lower and Middle Cambrian of Eastern Asia and North America)

The outline of the carapace varies among the genera. It is pyramidal and curved in *Stenothecopsis* and *Lapworthella*. *Stenotheca* is a low cone with a reflexed apex, or even coiled like *Pelagiella*, but the coiling is in a plane in *Stenotheca*. Among these genera the aperture varies considerably and the surface has frequently folds or ridges which are usually concentric and not radial in some of the ribeirioids. The test of carapace is phosphatic in *Heraultia* and the outer layer of the carapace is chitinous in *Lapworthella*, while the shells, so far as the Asiatic material concerns, the carapace of the Eopteridae is calcareous.

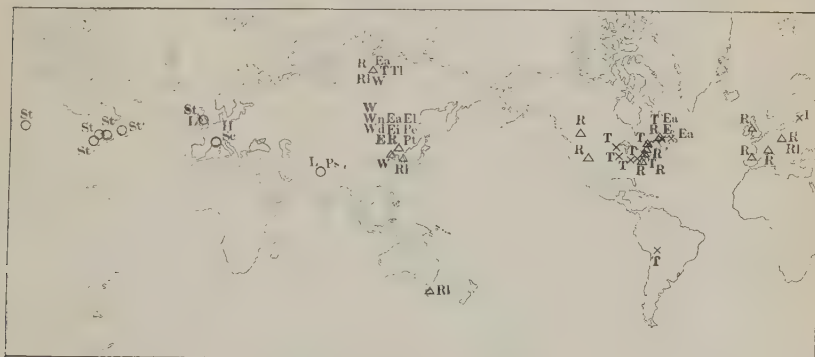
So far as I am aware, the most allied form to *Rileiria* is *Heraultia*. Both coincide quite well in the general outline, especially in the folded carapace with a reflexed apex and nearly smooth surface of the test, but the material of the carapace is quite distinct. Further, nothing is known of the interior of *Her-*

(1) E. S. COBBOLD (1934), The Cambrian Genus *Stenotheca*, (Geol. Mag. Vol. LXXI.) pp. 463-468, pl. XXIII.

aultia. The whole Lower and Middle Cambrian group including *Heraultia* are very small in comparison with the Eopteridae.

Although no Middle Cambrian linking form has as yet been discovered, the Eopteridae may be developed from *Heraultia* or its allied form, and a great change of carapace which is accountable of the difference between *Heraultia* and *Ribeiria* is expected to happen in the Middle Cambrian.

6. *Geological and Geographical Distribution of the Eopteridae*.—Since the time I made a revision on the ribeirioid, I described two species from South Chosen which are *Ribeiria* (?) *coreanica* KOBAYASHI from the *Clarkella* zone of Saishori, Jotomen, Neietsu-gun, Kogen-do⁽¹⁾ and *Eopteria* (?) *trilobita* KOBAYASHI from the Tsubon beds of Kochiri, Jochyomen, Sanchoku-gun, Kogen-



Map showing the distribution of the ribeirioids and related forms.

- | | | | |
|----|---|----|-----------------------|
| ○ | Lower and Middle Cambrian fossil locality | | |
| H | <i>Heraultia</i> | Sc | <i>Stenothecopsis</i> |
| L | <i>Lapworthella</i> | St | <i>Stenotheca</i> |
| Ps | <i>Pseudotheca</i> | | |
| △ | Upper Cambrian and Lower Ordovician fossil locality | | |
| E | <i>Euchasma</i> | R | <i>Ribeiria</i> |
| El | <i>Euchasmella</i> | Rl | <i>Ribeirella</i> |
| Ea | <i>Eopteria</i> | Tl | <i>Tolmachoria</i> |
| Ei | <i>Eoischyrina</i> | W | <i>Wanwania</i> |
| Pe | <i>Pseudoeuchasma</i> | Wn | <i>Wanwanella</i> |
| Pt | <i>Pseudotechnopholus</i> | Wd | <i>Wanwanoides</i> |
| x | Middle and Upper Ordovician fossil locality | | |
| T | <i>Technophorus</i> | I | <i>Ischyrina</i> |

(1) T. KOBAYASHI (1934), Cambro-Ordovician Formations and Faunas of South Chosen, Palaeontology Pt. II, Lower Ordovician Faunas, (Jour. Fac. Sci., Imp. Univ. Tokyo, Sect. II, Vol. III, Pt. 9.)

do.⁽¹⁾ The latter species is rather dubious, but if it is really a ribeirioid, it must be a new genus. The former is a ribeirioid without question and through reexamination I have found it referable to *Ribeirella*. THORAL⁽²⁾ reported the occurrence of *Ribeiria* and *Ribeirella* in Southern France. Recently I had an opportunity to study jointly with Prof. B. F. HOWELL at Princeton University, some early Palaeozoic fossils from the Katanga and Anabar regions in Siberia, collected by Dr. I. P. TOLMACHOFF of the Carnegie Museum, among which we found several species of ribeirioids distributed in *Wauwania*, *Ribeiria*, *Eopteria*, *Ischyria* and *Tolmachovia*.⁽³⁾

As suggested in a recent paper of mine,⁽⁴⁾ an unnamed form used to be considered as a bivalve from the brachiopod fauna of Table Cape conglomerate in Tasmania is, so far as the illustration is concerned, quite possibly a *Ribeirella*. Further, as described in the preceding page, *Technophorus* is found in South America.

Thus, the distribution of the family is now almost world-wide, although it has not yet been uncovered from the Ordovician of the polar regions. Geologically speaking, it appears first in the Upper Cambrian of Eastern Asia; subsequently, in the Lower and Middle Ordovician it spread not only into Europe and North America, but also southwardly into Australia and northwardly into Siberia. Then the center of distribution was shifted from the Pacific side to the Atlantic and extended into South America. The exclusion of *Ribeiria* (?) *prosseri* confines the family range to a duration from Upper Cambrian to Ordovician. *Ischyria* would be the latest survivor and with it the family disappeared completely in the Atlantic region. The family is therefore can be said to be one of significances in the Ordovician biota.

(1) T. KOBAYASHI (1934), *ibid.* Palaeont., Pt. I, Middle Ordovician Faunas, (Jour. Fac. Sci. Imp. Univ. Tokyo, Sect. II, Vol. III, Pt. 8.)

(2) M. THORAL (1935), Contribution à l'Étude Paléontologique de l'Ordovicien inférieur de la Montagne Noire. Montpellier.

(3) B. F. HOWELL and T. KOBAYASHI (1933), New Cambrian and Ordovician Faunas from Northern Siberia, (Abstract). (The Geol. Soc. America, Preliminary List of Titles and Abstracts of Papers to be offered at the 46th Annual Meeting Chicago, Illinois.) p. 73.

(4) T. KOBAYASHI (1936), Three Contributions to the Cambro-Ordovician Faunas, II, Notes on Some Ordovician Faunas of Tasmania, (Japan. Jour. Geol. Geogr. Vol. XIII,) p. 182.

7) *As to the Migration and Evolution of the Cambro-Ordovician Life*:—*Volborthella*⁽¹⁾ which is considered as a progenitor of the cephalopod by some authors is widely distributed in the Lower Cambrian of the Atlantic province. After a large blank of the Middle Cambrian page we meet with the true cephalopod, *Plectronoceras*⁽²⁾ which appears in the Upper Cambrian of Eastern Asia. Subsequently, in the Lower Ordovician the ellesmereoceroid develops considerably in the Pacific realm. Such an aspect of evolution is quite similar to that of the Eopteridae. The forerunner of the Eopteridae is found in the Lower Cambrian of the Atlantic realm, but the true ribeirioid appears first in the Upper Cambrian of Eastern Asia. Between the Upper Cambrian and older ones is seen a considerable difference in size and other natures in the cases of the Eopteridae as well as the Plectronoceratidae. This appears to suggest that the animal, in entering one realm to another, was required a great transformation to adapt in the new environment, but if adapted, its successor enjoys the flourishing.

With a contrast to the provincial nature of the Lower Cambrian faunas, some definite communications between the Atlantic and Pacific oceans are indicated by the common occurrences of *Conocoryphe*, *Dorypyge* and *Protolenus* in the Middle and late Lower Cambrian periods.⁽³⁾ Such demonstrates the chance offered to *Volborthella* and *Heraultia* to send their successors to the Pacific region.

It may be true that several evolutionary lines happen to originate in the Atlantic province in one period and migrate and develop in the Pacific in another, or vice versa. The Dikelocephalidae⁽⁴⁾ is the latter example which appears first in the Pacific in

(1) O. H. SCHINDEWOLF (1934), Bau und systematische Stellung der Gattung *Volborthella* Schm. (Palaeont. Zeitsch. Bd. 16.)

(2) T. KOBAYASHI (1935), On the Phylogeny of the Primitive Nautiloids, with Descriptions of *Plectronoceras*, *Naotungense*, new species, and *Iddingsia* (?) *shantungense*, new species. (Japan. Jour. Geol. Geogr. Vol. XII.)

(3) T. KOBAYASHI (1935), The Cambro-Ordovician Formations and Faunas of South Chosen, Palaeontology Pt. III, Cambrian Faunas of South Chosen with a Special Study on the Cambrian Trilobite Genera and Families. (Jour. Fac. Sci., Imp. Univ. Tokyo, Sect. II, Vol. IV, Pt. II.)

(4) T. KOBAYASHI (1936), Three Contributions to the Cambro-Ordovician Faunas, I. The Dikelocephalinae (nov.) its Distribution, Migration and Evolution, (Japan. Jour. Geol. Geogr. Vol. XIII.)

the late Middle Cambrian period and dominates in the Upper Cambrian in the same province. Since the late Upper Cambrian the Dikelocephalininae takes a constant eastward route from the maritime province of North America and comes back to the western Pacific through Europe and Himalayan trough in the Lower Ordovician period.

These three examples coincide in the direction of the migration. Future researches may bring out the examples of westward migration. Anyhow the migration of the marine animal is evidently controlled by the oceanic current, and therefore such examples might suggest something of the oceanic current, and consequently the rotation of the earth, in the remote past.

Acknowledgement:—I express here my gratitude to Dr. E. O. ULRICH and Dr. Ch. E. RESSER of the U. S. National Museum for the opportunity to study a number of ribeirioids, to Dr. RUDOLF RUEDEMANN of the New York State Museum for his courtesy which facilitated my study on CLARKE's type, to Prof. W. SOERGEL of the Geol. Inst., University at Freiburg for the privilege to describe *Technophorus* from South America, to Dr. I. P. TOLMACHOFF of the Carnegie Institute for that to study his Siberian Collection, and to Dr. C. J. STUBBLEFIELD of the Geological Survey at London and Dr. JAN KOLIHA of the Barrandeum at Prag for seeing old types in the museums for comparison.

リベイリア類の奥陶紀に於ける世界的分布に就いて (摘要)

小林 貞一

1. 此の類の科の名稱 Ribeiridae KOBAYASHI 1933 を Eopteridae MILLER 1889 に改め, 2. *Ribeirella* と *Technophorus* の共に獨立せる屬なることを述べ, 3. *Ribeiria*? *prosseri* Clarke は此の類に屬せず本種を基本種として二枚介の新屬 *Schizoepecten* を樹立し, 4. 南米ボリビア産の *Technophorus otaviensis* を記載す。5. 中下部寒武利紀フオーナ中に於いては *Heraultia* の最も *Ribeiria* に近似する點より此の類が Eopteridae の祖先型系統に近きものと思ふ。6. Eopteridae は上部寒武利亞紀に於いては東亞, 中下部奥陶紀に於いては北はシベリア, 南はタスマニアに發見され, 太平洋兩測に廣く分布し, 中上部奥陶紀に於いては大西洋兩側に多く, 南は南米ボリビアに發見される。7. 中下部寒武利亞紀に *Volborthella* あり, 眞正頭足類は上部寒武利亞紀以降に發展すること, Eopteridae の系統發達と類す, 寒武利奥陶紀のフオーナ中には或時期には太平洋區域に, 次の時代には大西洋區域に發展するが如き態の系統發達をなすもの其の例に乏しからず, 茲に頭足類, Eopteridae, Dikelocephalidae の三例を擧げて其の一解釋に及ぶ。

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All Communications relating to this Journal should be addressed to the
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